IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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TITLE: HEADPHONE FOR SPATIAL SOUND REPRODUCTION

Amendment A: REMARKS

Upon entry of the present amendments, previous Claims 1 - 6 have been canceled and new Claims 7 - 12 substituted therefor. Reconsideration of the rejections, in light of the forgoing amendments and present remarks, is respectfully requested. The present amendments have been entered for the purpose of distinguishing the present invention from the prior art and also for the purpose of placing the claim language into a more proper U.S. format.

In the Office Action, Claims 1 - 6 were rejected under 35 U.S.C. § 103(a) as being unpatentable over the Meucci patent. The specification was objected to because of the various informalities. The drawings were objected to under 37 C.F.R. § 1.84(p)(4) for various reasons. The claims were also objected to as being enabling under 35 U.S.C. § 112, first paragraph and for being indefinite under 35 U.S.C. § 112, second paragraph.

As an overview to the present reply, Applicant has revised the claims in the form of new Claims 7 - 12. These new express the original limitations, but express such limitations in a more proper U.S. format. In particular, new independent Claim 7 and 12 also include the "omnidirectional sound producing means". As such, the nature of the sound provided by the headphones to the listener or by the "microphones" to the user are now specifically defined. The omnidirectional sound

producing means is recited as being connected to the pair of headphones so as to reproduce a spatial quality of sound by application of a Huygens Fresnel principle so that a sound surface corresponds to an addition of spherical waves emitted by the speakers (or microphones). The two adjacent speakers are now recited as being "spaced by a distance less than a distance of one-half of the shortest wavelength corresponding to a given maximum frequency". The given maximum frequency is "a frequency that is audible to the ear of the listener". Applicant respectfully contends that these features serve to distinguish the present invention from the prior art Meucci patent.

The headset of the Meucci patent has "directional" speakers which radiate so as to be focused and directional to the auricle of the user through the use of the wave guides. The spacial reproduction process that occurs by the headset of the Meucci patent is different than that of hereto present invention. First, the speakers and the headset of the Meucci patent are directional and cannot be considered as "omnidirectional sound sources". Additionally, the spacial quality of the sound is obtained by focusing and directionalization of the radiation of the speakers (as found in column 3, lines 48 - 54 of the Meucci patent). This is not the process as defined by the present invention in which the Huygens Fresnel principle is applied so as to reproduce the spacial quality of the sound. Thirdly, the spatial origin of the sound in the Meucci patent is obtained by making the speakers emit sound in the direction corresponding to that of the sound to be reproduced (see column 9, lines 28 - 41 of the Meucci patent). This is different than the present invention in which the sound surface is reproduced corresponding to the addition of spherical waves emitted by the speakers.

Relative to the obviousness of the present invention with respect to the Meucci patent, the process of the Meucci patent is different than that of the present invention in that the spacial quality of the sound is obtained by focusing and directionalization of the sound toward the auricle of the

listener (see column 5, line 62 of the Meucci patent). In order to achieve this, each speaker of the Meucci patent is directional due to the presence of waveguide tubes. The spatial origin of a sound is obtained by a speaker that is situated in the corresponding direction of the sound to reproduce (see column 8, lines 28 - 41 and column 9, line 63 through column 10, line 14 of the Meucci patent). As a result, the headset of the Meucci patent permits one to reproduce a limited number of sound origin directions, namely one per speaker. For example, in the Meucci patent, there would be eleven sound origin directions for a headset having eleven speakers.

In contrast, in the process in conformance with the present invention, one is able to reproduce an unlimited number of sound origin directions by reproducing a sound surface through the application of the Huygens Fresnel principle. The present invention increases the universality of reproduction due to the utilization of omnidirectional fields. The reproduced sound surface does not only excite the point of entry of the ear canal but also the entire auricle. As a result, the present invention allows the natural diffractions to produce themselves at the auricle of the user.

The apparatus of the present invention differs from that of the Meucci patent in that the speakers are ideally assimilated to omnidirectional sources. In contrast, the Meucci patent, the speakers are made directional by waveguides. One having ordinary skill in the art would not modify the headset of the Meucci patent in order to suppress the waveguides since the headset would thus be incapable of implementing the process as described in the Meucci patent.

Independent Claim 12, in relation to the recording device, differs from the headset of the Meucci patent in that the speakers of the Meucci patent are replaced with omnidirectional or cardioid microphones. Applicant respectfully contends that one having ordinary skill in the art would have no reason to replace the speaker of the Meucci patent with microphones. In fact, in the Meucci

patent, following a sound signal, the spatial quality and the origin of the source of the sound are obtained simply by having this signal be emitted by the speaker from a position that is the most appropriate one in the headset. In the present invention, the recording device permits the simultaneous recording of signals related to sound waves and in positions corresponding respectively to the headset microphones. The origin of the sound is simulated by placing the sound source in different positions with respect to the recording device. The headset of the recording device can be worn by an artificial or real head during the recording phase in order to take the listener's presence into account. The sound surface will be reproduced by making the speakers of the headset in conformance with the present invention emits simultaneously the previously recorded signals. To reproduce the origin of the sound, the speakers of the headset in association with the present invention are emitting all in concert in contrast to the process described in the Meucci patent. On this basis, Applicant respectfully contends that independent Claim 12 is patentably distinguishing from the Meucci patent.

Applicant has revised the specification extensively so as to conform with the Examiner requirements. The reference numeral "4" has been deleted from the previously-submitted drawings. A Replacement Sheet is provided herewith. Dependent Claims 8 - 11 correspond, respectively, to the limitations found in previous dependent Claims 3 - 6.

Based upon the foregoing analysis, Applicant contends that independent Claims 7 and 12 are now in proper condition for allowance. Additionally, those claims which are dependent upon these independent claims should also be in condition for allowance. Reconsideration of the rejections and allowance of the claims at an early date is earnestly solicited. Since no new claims have been added above those originally paid for, no additional fee is required.

Respectfully submitted,

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